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2878

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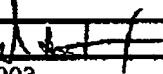
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Total Number of Pages in This Submission

14

Application Number	09/423,534
Filing Date	December 14, 1999
First Named Inventor	LAU
Art Unit	2878
Examiner Name	T. Luu
Attorney Docket Number	1-14746

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

LAU

Serial No.09/423,534

Examiner: T. Luu

Filed: December 14, 1999

Group Art Unit: 2878

FOR: DEVICE FOR MEASURING
LIGHT ACTIVATED
FLUORESCENCE AND ITS USE

Attorney Docket 1-14746

August 7, 2003

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AMENDMENT

Honorable Sir:

In response to the Final Office Action dated May 7, 2003, please amend the above-identified patent application as follows:

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IN THE SPECIFICATION

Please amend the specification as follows.

Please amend the paragraph beginning on line 32 of page 14, and extending onto page 15 as follows:

Represented in the right-hand representation of Figure 4 is a view orthogonal to the longitudinal axis of such a support 30, from which it may be seen that a plurality of regions can be separated optically from one another (also possible in the following examples) by, for example, reflecting layers 38 36, and different layers 32.1, 32.2 and 32.3 are applied or constructed in the regions. Given these different layers 32.1 to 32.3, it is possible to use a measuring head 1 according to the invention to determine a plurality of material concentrations simultaneously and/or to carry out at least one reference measurement in one of these regions. The same reference numerals are used for identical elements in the following figures.

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IN THE CLAIMS

Please amend the claims as follows. A separate marked-up copy of the amended claims is presented herewith.

23. (presently amended) Device for measuring fluorescence excited by light, which has at least one layer which is applied to a support and which at least one layer contains a fluorescing material, having at least one light source which emits light of at least one wavelength that excites fluorescence(s) and thus fluorescent light in the at least one layer, and which exciting light is directed through the support onto the at least one layer by at least one first optical conductor, the fluorescent light being directed by at least one second optical conductor onto at least one detector for determining the intensity of the fluorescent light, wherein the end faces of all the first and second optical conductors are arranged relative to one another as a function of their numerical apertures and as a function of the at least one layer containing a fluorescing material and which layer is applied to the support, and the first and second optical conductors which are arranged as a bundle in the shape of a ring with at least one first optical conductor, arranged in the interior of the ring, which optical conductors of the bundle are used for exciting light or for fluorescent light, or a plurality of the first and second optical conductors are arranged in series arrangements opposite one another, with one of the first optical conductors and a corresponding one of the second optical conductors forming pairs, such that it is possible to achieve a defined localized

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distribution of measurable fluorescence intensity, and the light source(s), the at least one first and at least one second conductors and the detector(s) are held in a measuring head.

24. (previously presented) Device according to claim 23, wherein a part of the measuring head holds outer ends of the optical conductors, and at least the part of the measuring head which holds the outer ends of the optical conductors is of flexible construction.

25. (previously presented) Device according to claim 23, wherein the measuring head has an upper region which is at least partially bent.

26. (previously presented) Device according to claim 23, wherein at least one of a filter, a system of exchangeable filters or a launching optical system is arranged between the light source and at least one first optical conductor.

27. (previously presented) Device according to claim 23, wherein the optical conductors are arranged in the shape of a ring, a circular arc or a star on an end of the measuring head pointing towards the at least one layer containing fluorescing material.

28. (current amended) Device according to claim 23 27, wherein the at least one second of the second optical conductors is optical conductor for conducting exciting light, reference light or further fluorescent light comprises a plurality of second optical conductors which are arranged in an alternating fashion in an outer ring, and a portion of the second optical conductors for conducting fluorescent light are arranged in an inner ring.

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29. (previously presented) Device according to claim 23, wherein the at least one first and the at least one second optical conductors are inclined at different angles with their ends pointing towards the fluorescing layer.

30. (previously presented) Device according to claim 23, wherein there is arranged on an upper measuring head region a heater having a temperature sensor and a controller or regulator which is arranged in the measuring head and maintains a prescribable temperature at the fluorescing layer(s).

31. (previously presented) Device according to claim 23, wherein the support, which is transparent to exciting light and fluorescent light has a surface which contains partially polished or reflecting surface regions or is surrounded by a medium of lower refractive index, and is mounted in an exchangeable fashion on the measuring head.

32. (previously presented) Device according to claim 31, wherein exciting light is launched into the support with the aid of at least one optical conductor such that the exciting light is totally reflected at least in the region of the layer, and total reflection occurs.

33. (previously presented) Device according to claim 31, wherein the support is constructed in an elongated fashion in a plane.

34. (previously presented) Device according to claim 31, wherein the support is subdivided along its longitudinal axis into a plurality of regions.

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35. (previously presented) Device according to claim 31, wherein, on an end face opposite an end face into which the exciting light can be launched, the support has an angular surface and a layer of at least one layer which contains fluorescing material and at which the exciting and fluorescing light is reflected in the direction of a planar optical conductor constructed symmetrically relative to the support, and the light from the angular surface thereof is directed onto an end face arranged at the other end of an optical conductor, and from there at least fluorescent light is directed onto a detector via at least one of the optical conductors, the support and planar optical conductor being arranged at a spacing from one another or being optically separated into the region of the angular surface.

36. (previously presented) Device according to claim 31, wherein the support is of a-shaped construction comprising two limbs, the two limbs are optically separated from one another, and the exciting light can be launched into an end face of a limb via at least one additional optical conductor, and at least fluorescent light can be coupled out via the end face of the other limb into at least one further optical conductor, which at least one additional optical conductor and at least one further optical conductor are in addition to the at least one first and at least one second optical conductors.

37. (previously presented) Device according to claim 36, wherein the two limbs of the u-shaped support are connected in the shape of a bow, a wedge or a cone, or by means of an angular web.

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38. (previously presented) Device according to claim 23, wherein heating elements are integrated into the support.

39. (previously presented) Device according to claim 23, wherein between one of the optical conductors and one of the at least one layers containing the fluorescing material, a transparent body made from optically scattering material is arranged or a body comprising a diffusely scattering surface is positioned facing the layer.

40. (previously presented) Device according to claim 39, wherein the body is formed from optically transparent material which contains light-scattering particles.

41. (previously presented) Device according to claim 23, wherein at least one further optical conductor directs reference light onto a further detector for detecting a reference signal.

42. (previously presented) Device according to claim 23, wherein an upper heated region is thermally insulated with respect to a lower region, in which lower region the light source(s) and the detector(s) are held.

43. (previously presented) Device according to claim 23, wherein said device is configured to detect fluorescence-quenching, fluid materials.

44. (previously presented) Device according to 23, wherein the support is configured to receive heating elements.

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REMARKS

Responsive to the outstanding Office Action, applicant has carefully studied the Examiner's comments. It is respectfully submitted that no new matter has been presented in this amendment. The claim amendments here in have been made for the purpose of correcting informalities in the claims as identified by the Examiner. Therefore, no new issues have been raised by the presentation of this amendment. Thus, entry of the proposed amendments and favorable reconsideration of the application is respectfully requested.

The claims pending in the application are claims 23-44. In the amendment, applicant has amended claims 23 and 28 in order to correct indefiniteness issues. Additionally, the paragraph bridging pages 14 and 15 has been amended to correct a typographical error.

The Examiner approved the earlier amendments to the drawings, but objected to the reference numeral "38" which was present in the specification but not in the drawings. In response thereto it is submitted that the reference numeral "38" in the specification was a typographical error, and should have been reference numeral "36" which is correctly shown on the drawings. This has been corrected in the specification. It is believed that the drawings now comply with the requirements of 37 CFR 1.84(p)(5). Formal drawings will be submitted upon issuance of a Notice of Allowance.

Additionally, the Examiner rejected claims 23-44 under 35 USC §112, second paragraph. The Examiner made specific rejections against claims 23 and 28. In response thereto, these

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claims have been amended to correct the deficiencies noted by the Examiner. It is thus believed that all of the claims fully comply with the requirements of 35 USC §112, second paragraph.

The Examiner continues to reject claims 23-28, 31-33 and 43 under 35 USC §103 as being unpatentable over Saaski et al. (U.S. Patent No. 5,606,170.) Claim 29 continues to be rejected under 35 USC §103 as being unpatentable over Saaski in view of Pederson et al. Claim 41 continues to be rejected under 35 USC §103 as being unpatentable over Saaski in view of Hesse. Claims 30, 38, 42 and 44 continue to be rejected under 35 USC §103 as being unpatentable over Saaski in view of Wagner and Bessman et al.

The Examiner has indicated that claims 34-37, 39 and 40 are rejected for being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including the limitations of their base claims and any intervening claims. For the reasons set forth below, it is submitted that broader claim coverage is available.

Before discussing the prior art in detail, the Examiner's attention is directed to the present invention, as claimed in amended independent claim 23. Claim 23 discloses a device for measuring fluorescence excited by light. The device has at least one layer which is applied to a support and which at least one layer contains a fluorescing material. At least one light source emits light of at least one wavelength that excites fluorescence(s) and thus fluorescent light in the at least one layer. The exciting light is directed through the support onto the at least one layer by at least one first optical conductor, the fluorescent light being directed by at least one second optical conductor onto at least one detector for determining the intensity of the fluorescent light. The end faces of all the first and second optical conductors are arranged relative to one another as

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a function of their numerical apertures and as a function of the at least one layer containing a fluorescing material and which layer is applied to the support. The first and second optical conductors are arranged as a bundle in the shape of a ring with at least one first optical conductor, arranged in the interior of the ring, which optical conductors of the bundle are used for exciting light or for fluorescent light, or a plurality of the first and second optical conductors are arranged in series arrangement opposite one another, with one of the first optical conductors and a corresponding one of the second optical conductors forming pairs, such that it is possible to achieve a defined localized distribution of measurable fluorescence intensity, and the light source(s), the at least one first and at least one second conductors and the detector(s) are held in a measuring head.

Saaski et al. discloses a sensor system which is, general, an evanescent wave-excited, fluorescent light generating type sensor. The exciting light is directed into and through an optical conductor (76, 144, 206 in Saaski). An evanescent field is generated outside of the optical conductor as a result of reflections of the exciting light along the inner surface of the optical conductor. Fluorescence may be achieved at every point of the outer surface of the optical conductor, if a fluorescing material inside a generated evanescent field is placed there with sufficient energy. In the case of total internal reflection a maximum of evanescent energy can be achieved. Therefore, in Saaski, the energy level at different areas or points of the evanescent field is not equal. It is only possible to detect defined localized distributions of fluorescent intensity by using differing fluorospheres which are located separately.

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Pederson et al. discloses a fiber optic moisture sensor, comprising a housing and a support within the housing, with a film coating the support. First and second light guides are positioned to communicate illumination to and from the film. A reflective surface, within the housing, faces the film. The film includes an optically transparent polymer and a salt complex of a metal ion and an organic compound. The salt is capable of absorbing moisture and emits a fluorescent signal when excited by light at the appropriate wavelength. The light is quenched as the coating complex absorbs moisture.

Wagner discloses a method for monitoring the glucose level in a body fluid. The method of Wagner utilizes an apparatus including a conjugate of glucose oxidase and a fluorescent dye coated onto an optical fiber. An excitation light source is used to trigger fluorescence emission which is registered by a fluorescence emission detector. The fluorescent dye detects oxygen quenching, as fluorescence emission increases in direct proportion to the glucose concentration in the fluid.

Bessman discloses a method and apparatus for detection of glucose in the body. The apparatus detects the absolute level of oxygen concentration in the fluid and corrects the output differential measurement indicative of the glucose level according to the absolute level of oxygen.

Independent claim 23 continues to be rejected under Saaski alone. The inventive device of claim 23 utilizes a layer containing fluorescing material applied on a support and at least one first optical conductor for exciting and detecting fluorescence within the layer. The end faces of all of the optical conductors are arranged relative to one another as a function of their numerical

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apertures and as a function of the arrangement of the at least one layer containing the fluorescing material.

In contrast, the end faces of the optical fibers for exciting and detecting light are arranged to achieve a maximum intensity of the differing lights. Therefore, the numerical apertures of Saaski are arranged for this purpose, and not as a function of the at least one layer containing the fluorescing material as are the end faces of the optical fibers as claimed in claim 23. This factor would be neither important, nor suitable, for the fluorescence based immunoassay techniques using evanescent wave excitation. Such fluorescence based techniques utilize the outer surface of the optical fibers to form a boundary layer which is necessary for total internal reflection of exciting light and the excitation of evanescence outside of the optical fibers. The exciting light is guided inside of the optical fibers and reflected at the outer boundary surface with consideration of the total internal reflection conditions, with suitable angles for exciting the evanescence field. Thus, it is submitted that fluorescence evanescence techniques are special and different than that of the present invention.

The exciting light emitted out of an end face of a first optical conductor and directed to a layer, which is applied on a support and which contains fluorescing material, as well as a second optical conductor for directing fluorescence light, which is coupled to an end face of the second optical conductor to an optical detector, is thus not anticipated by, nor rendered obvious by Saaski. It is respectfully submitted that the arrangement defined in claim 23 of the end faces of the different optical conductors with respect to the arrangement of the fluorescing layer and their

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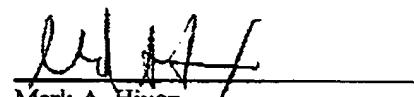
numerical apertures are not obvious in view of Saaski alone or in combination with any of the applied references.

It is therefore submitted that the prior art references, either Saaski alone, or in conjunction with any of the remaining references, do not anticipate, nor render obvious, the present invention, as disclosed in independent claim 23.

Claims 24-44, which depend directly or indirectly from an allowable claim 23, are believed to be allowable based, at least, upon this dependence.

Should the Examiner wish to modify the application in any way, applicant's attorney suggests a telephone interview in order to expedite the prosecution of the application.

Respectfully submitted,



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